

Fig. 1

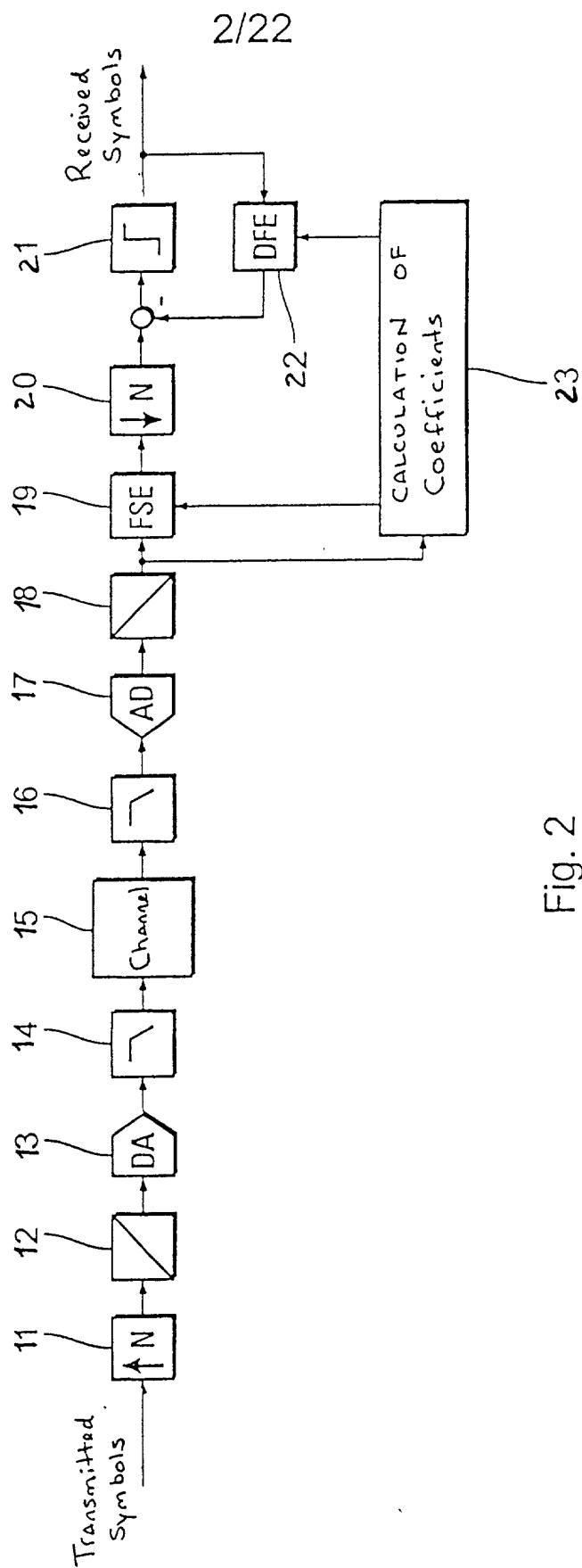


Fig. 2

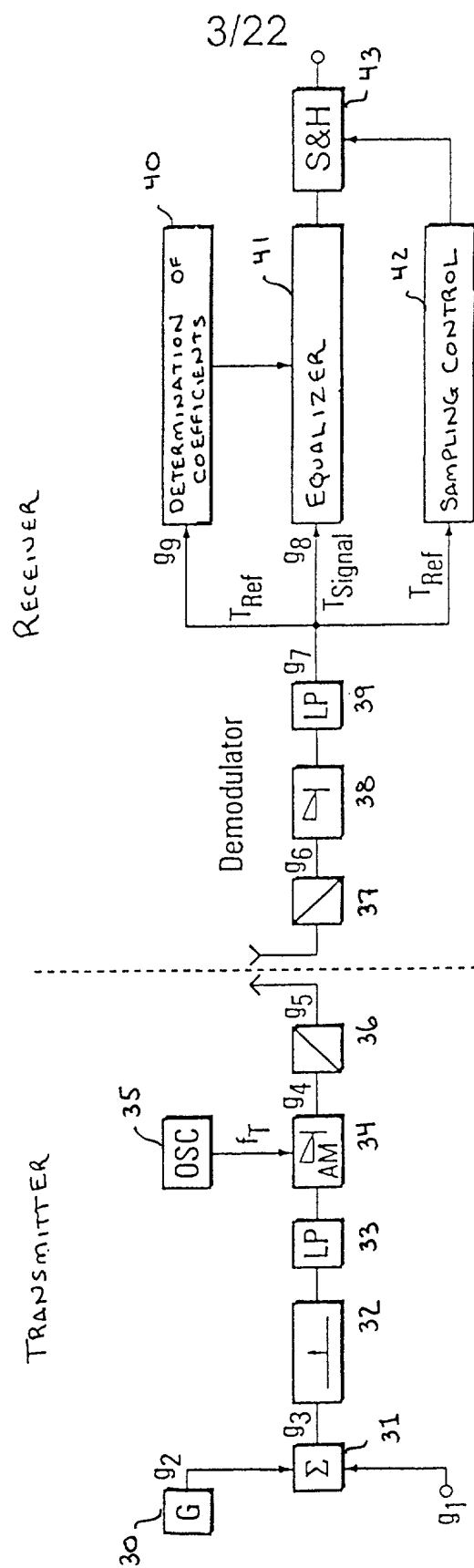


Fig. 3

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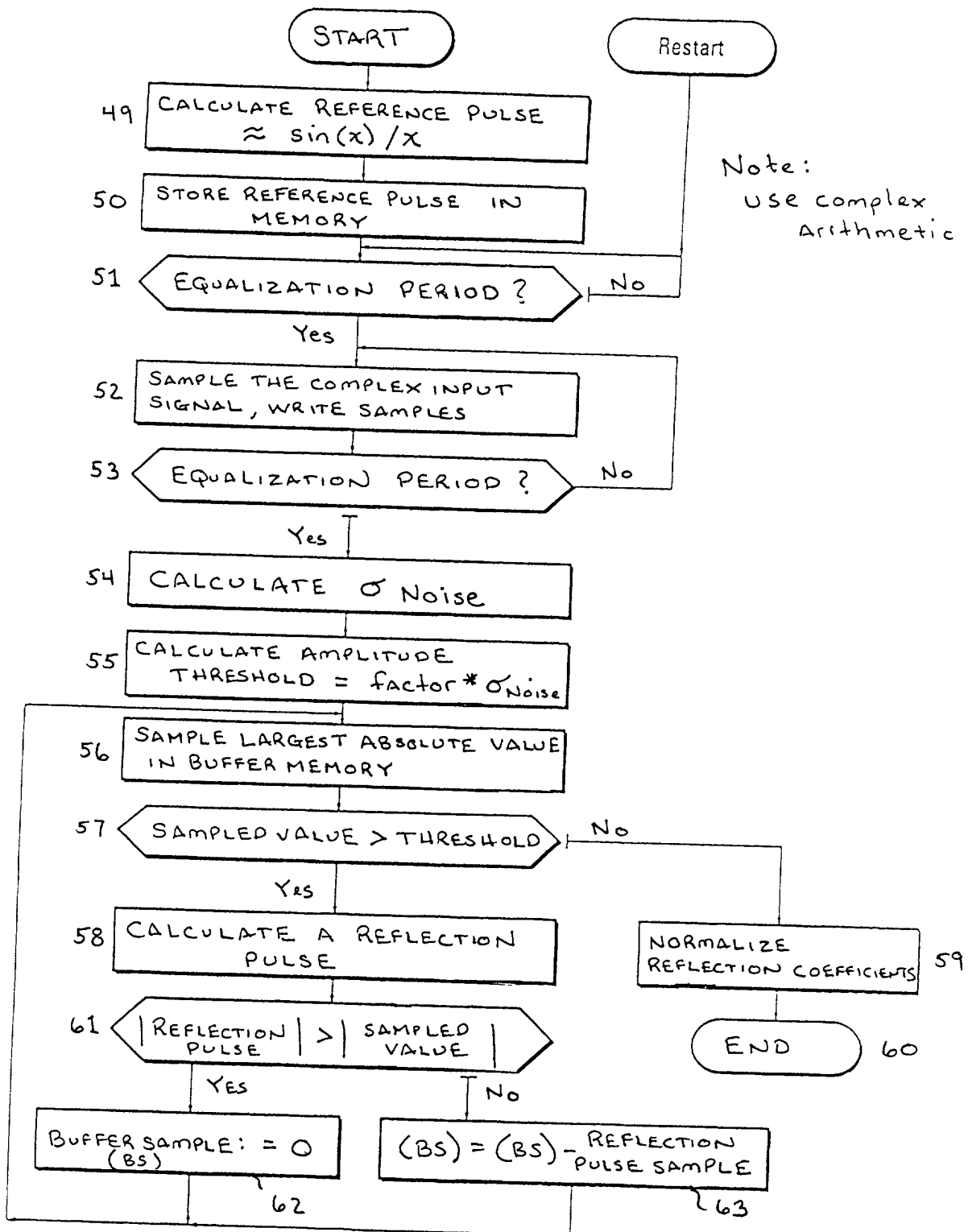


Fig. 7

10067793-02080

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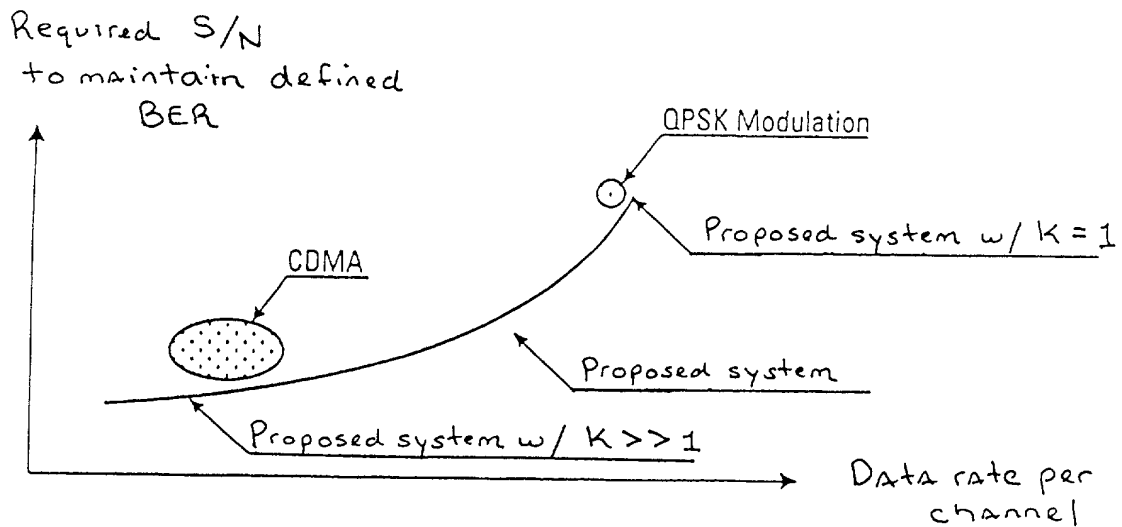


Fig. 9.1a

Simple modification of the  $K$  value, represents the difference in time between  $\Delta t = k \cdot \delta$

Example:

Constant transmitter power  $P_{\text{txmit}}$

Case 1:  $k = 10$

Case 2:  $k = 4$

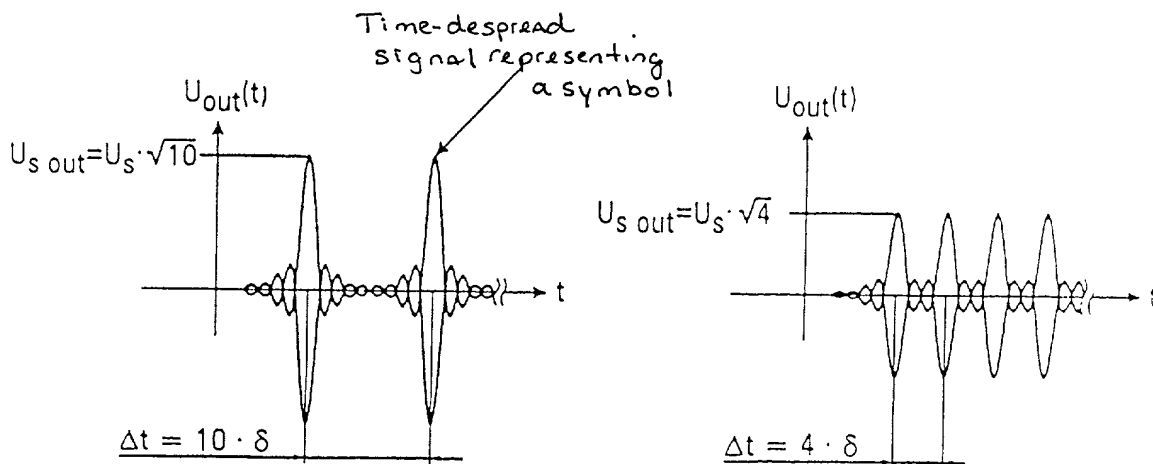


Fig. 9.1b

Fig. 9.1 System Characteristics

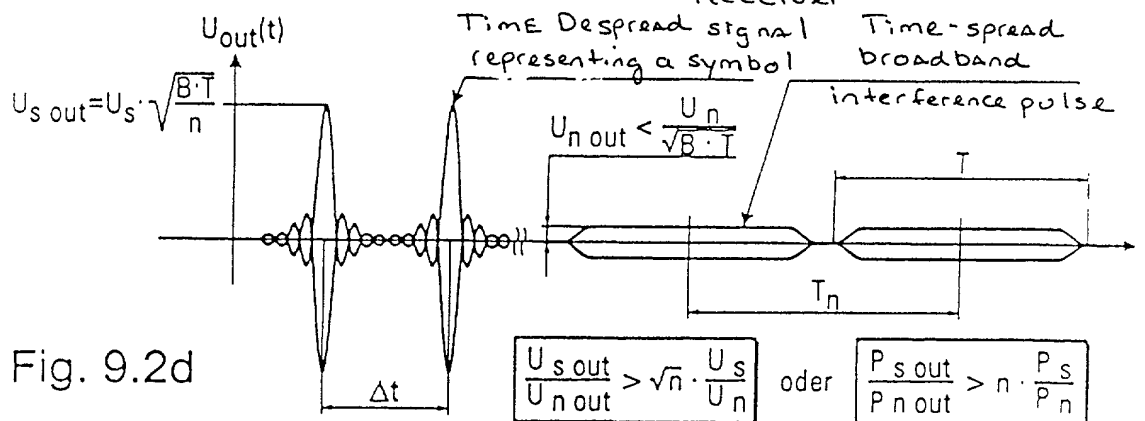
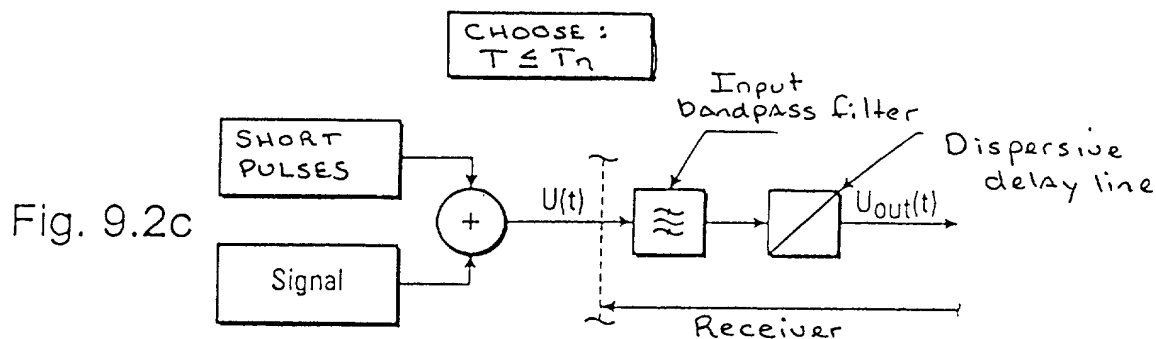
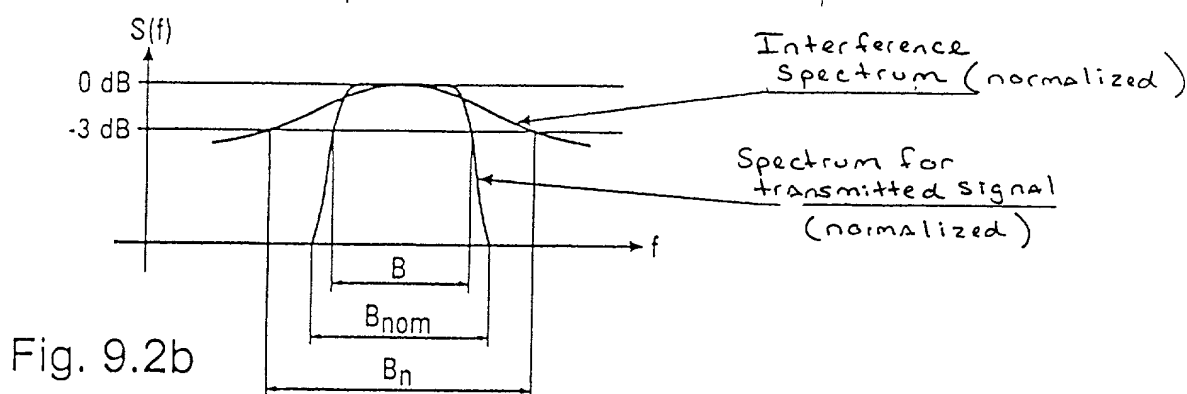
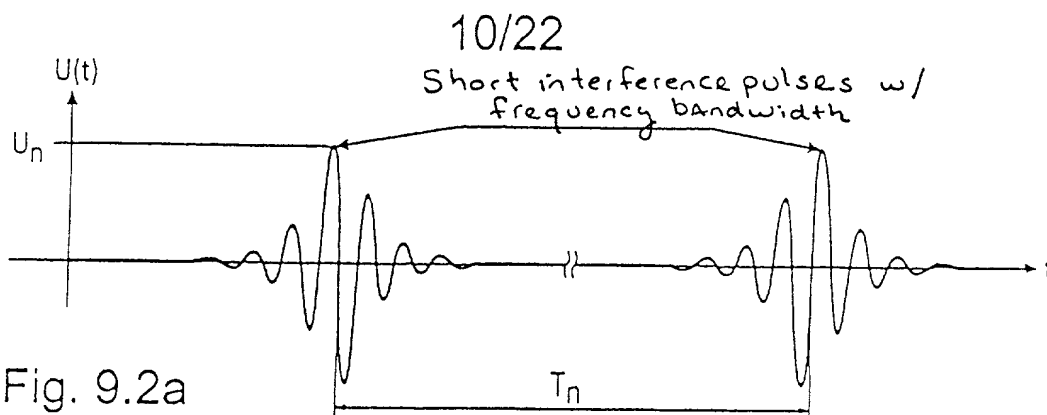


Fig. 9.2 BROADBAND INTERFERENCE

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from Fig 9.8

START

### System Status Analysis

#### Input Data:

$P_{max}$  - maximum transmitter power  
 $B_{nom}$  - nominal frequency bandwidth (@ 0 level of transmitter)  
 $r$  - equivalent roll-off factor  
 $D_{req}$  - required symbol rate  
 QPSK - modulation mode (example)  
 $N_{meas}$  - measured spectral noise power density  
 $A_{link}$  - measured value of link damping  
 $BER_{req}$  - required bit error rate (BER)  
 $T$  - chirp pulse duration

#### FREQUENCY BANDWIDTH

$$B := \frac{B_{nom}}{1+r}$$

#### Duration of compressed pulse

$$\delta := \frac{1}{B}$$

#### Analyze input noise and choose time T

$$T \leq T_n$$

Assign PRIORITIES to:  
 transmission speed  
 required bit error rate  
 transmitter power

#### HIGHEST PRIORITY is ASSIGNED TO:

TRANSMISSION SPEED	REQUIRED BIT ERROR RATE	TRANSMITTER POWER
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①

③

⑤

Fig. 9.3 Initialization & Priority Setting

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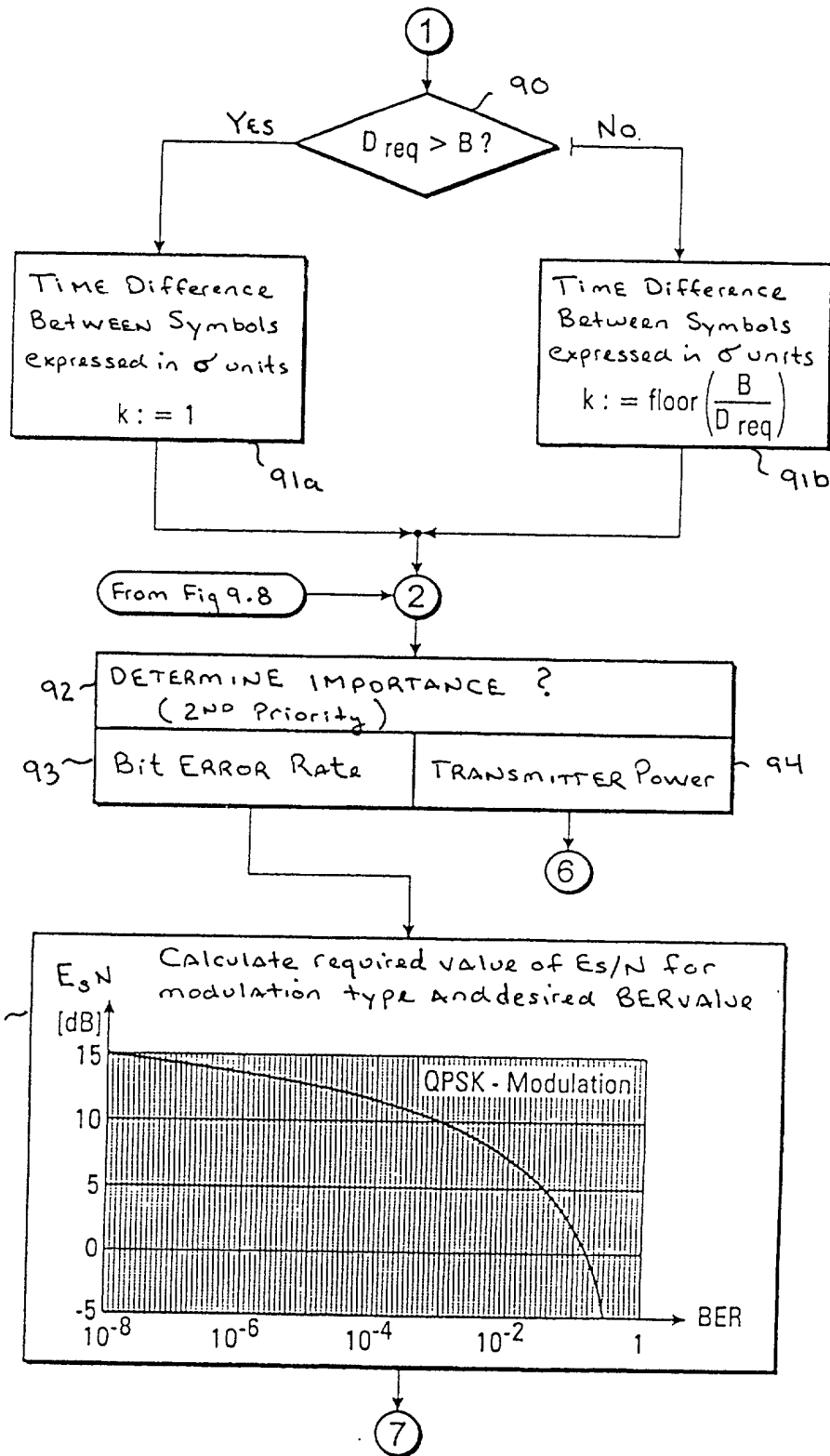


Fig. 9.4 Highest Priority: Transmission Speed

20200201 10067793 020802



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(3)

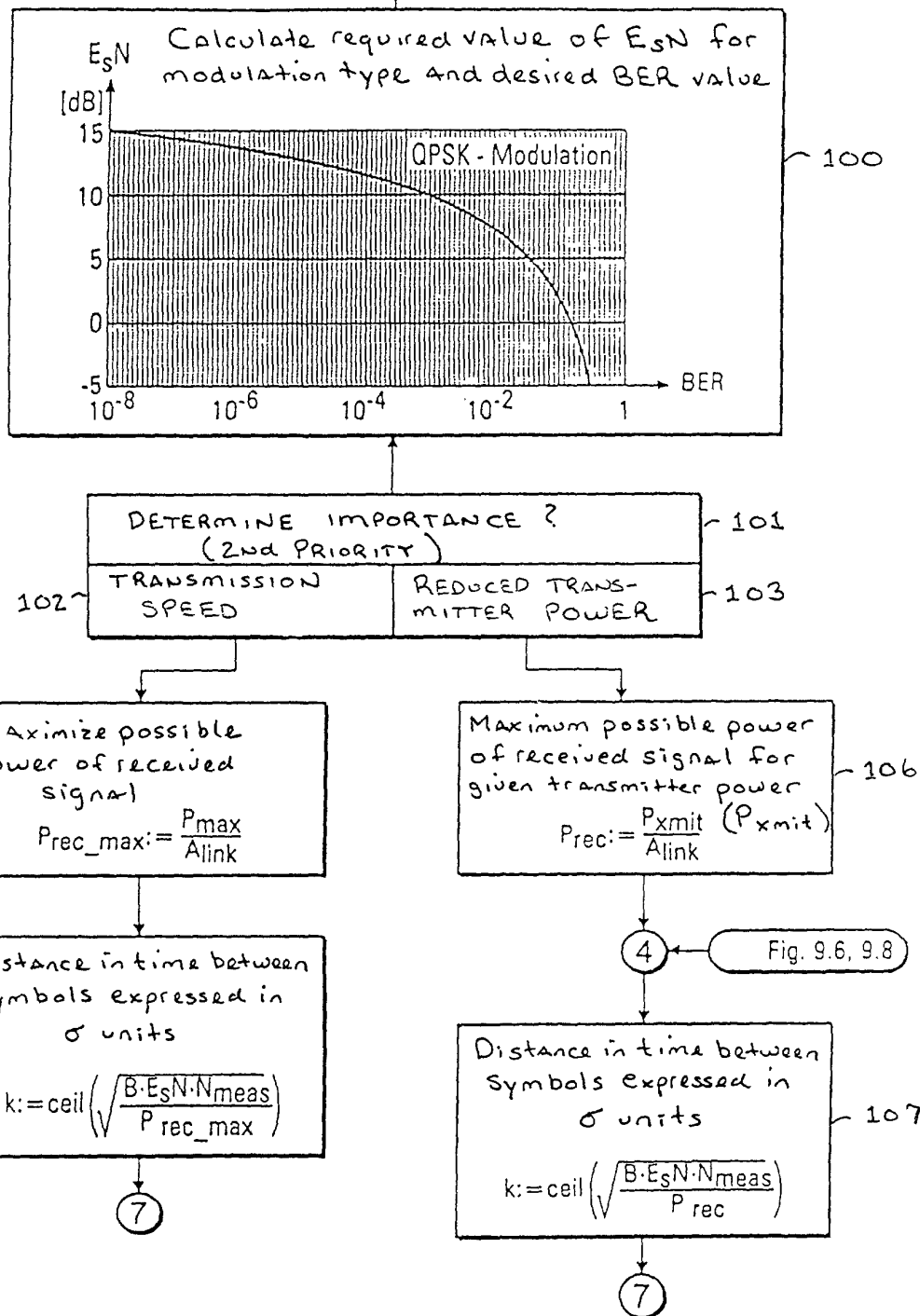


Fig. 9.5: Highest priority for: Required Bit Error Rate

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⑤

Maximum possible power  
of received signal for  
given transmitter power  
( $P_{xmit}$ )

$$P_{rec} = \frac{P_{xmit}}{A_{link}}$$

111

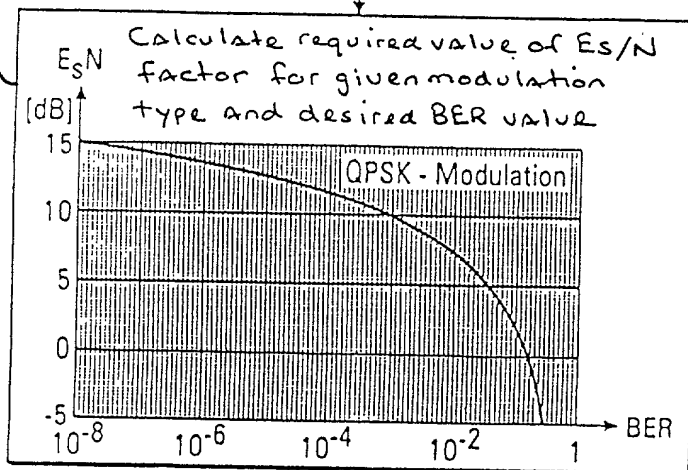
DETERMINE IMPORTANCE ?

112

113 BIT ERROR RATE

TRANSMISSION  
SPEED 115

114



④

No

116  $D_{req} > B?$ 

Yes

$$k := \text{floor} \left( \frac{B}{D_{req}} \right)$$

from Fig. 9.4, 9.8

$$k := 1$$

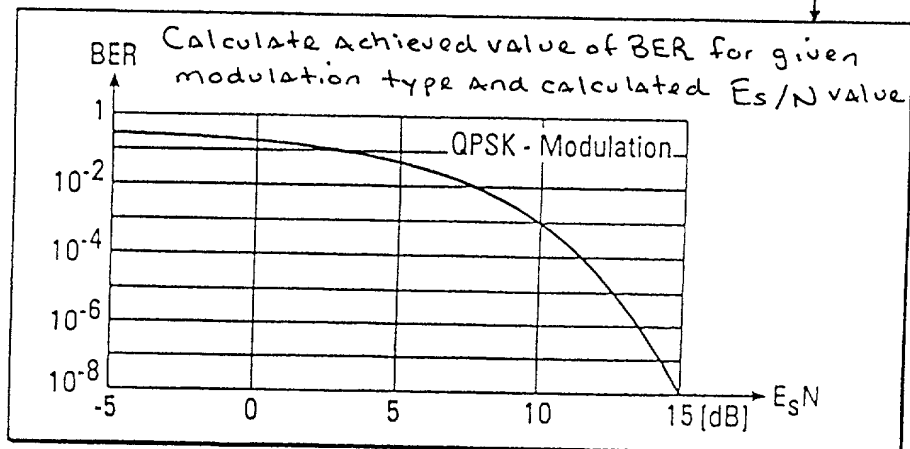
118

⑥

Es/N - Calculation

$$E_s/N := \frac{P_{xmit} \cdot k^2}{A_{link} \cdot B \cdot N_{meas}}$$

110



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⑧

Fig. 9.6 Highest Priority for: TRANSMITTER POWER

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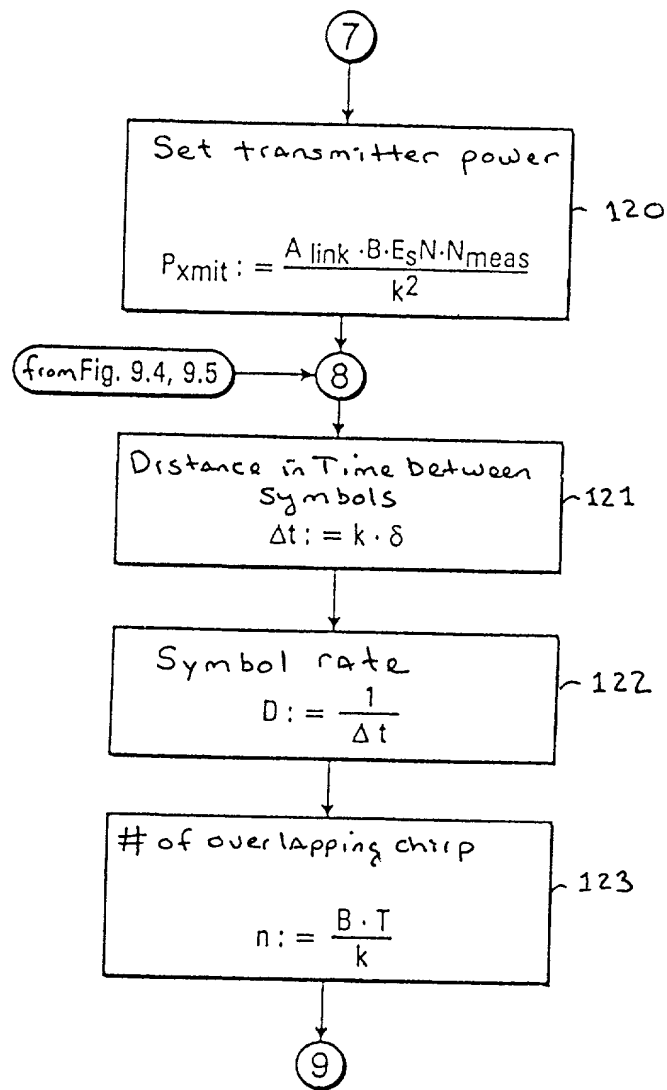


Fig. 9.7 System PARAMETERS

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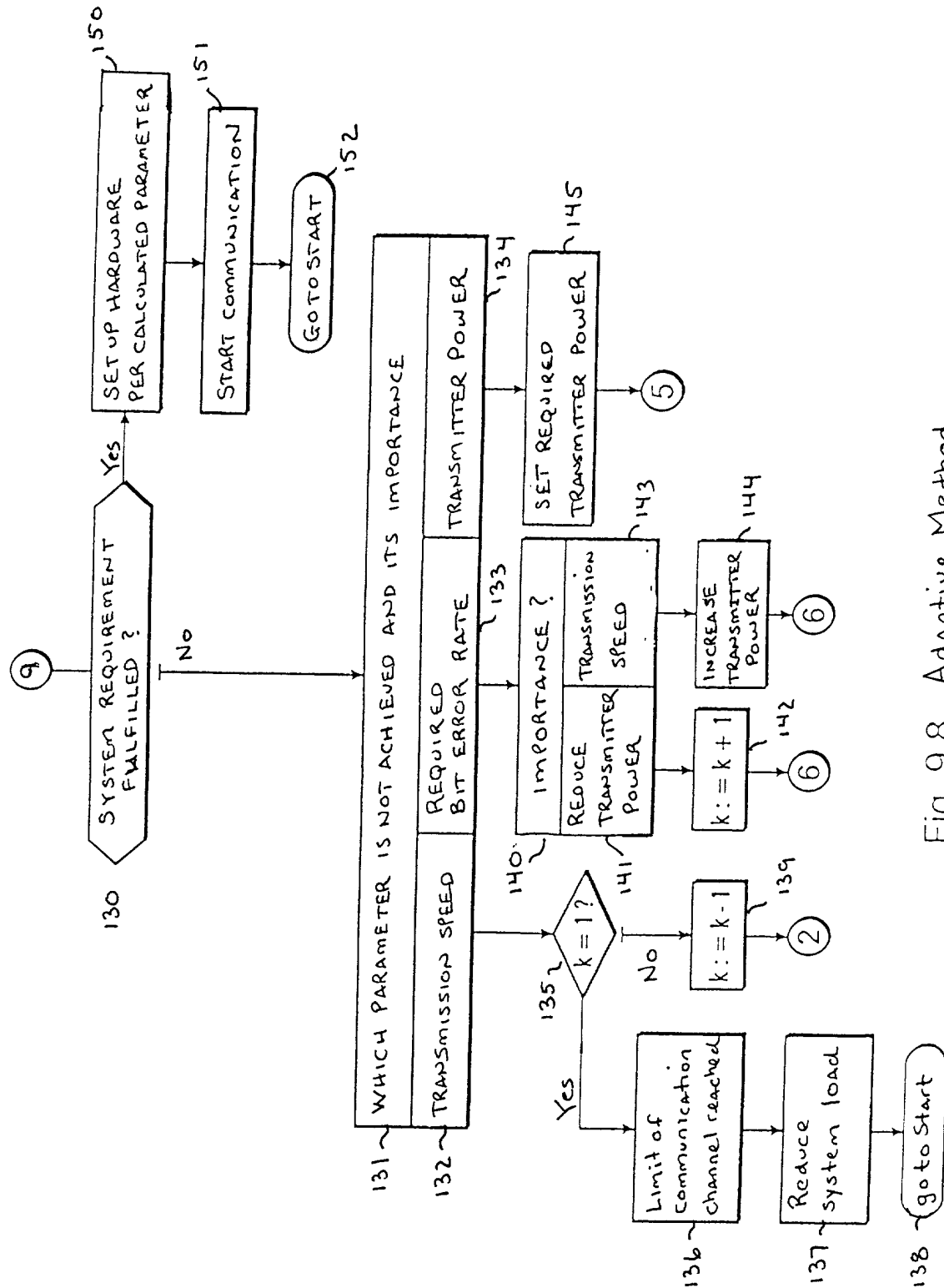


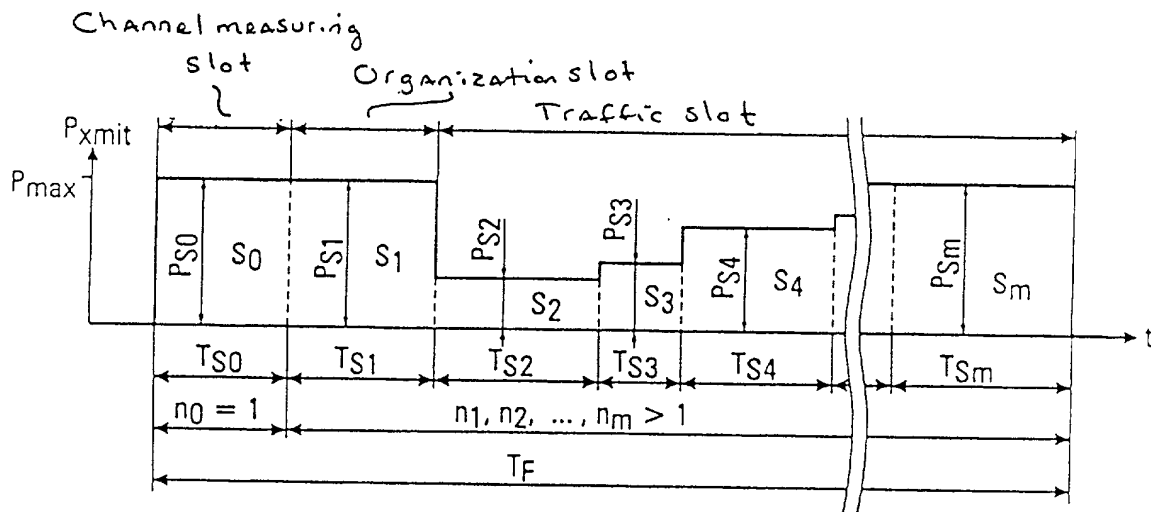
Fig. 9.8 Adaptive Method

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RESOURCE Allocation -  
arranged and controlled on  
the time axis enabling full system  
capacity to be used at all times to provide best efficiency

Example of Resource Allocation in TDMA Systems :

allocated resources are : signal power for each time slot ,  
duration of each time slot



where :

- $n_0, n_1, n_2 \dots n_m$  - number of overlapping pulses for timeslots
- $P_{max}$  - maximum transmitter power
- $P_{s0}, P_{s1}, P_{s2} \dots P_{sm}$  - Assigned transmitter power per timeslot
- $S_0$  - time slot 0 Assigned to time equalization method
- $S_1$  - time slot 1 Assigned to the organization channel
- $S_2$  - time slot 2 Assigned to the first traffic channel
- $S_3$  - time slot 3 Assigned to the second traffic channel
- $S_4$  - time slot 4 Assigned to the third traffic channel
- $S_m$  - time slot m Assigned to the last traffic channel

$T_F$  = frame duration

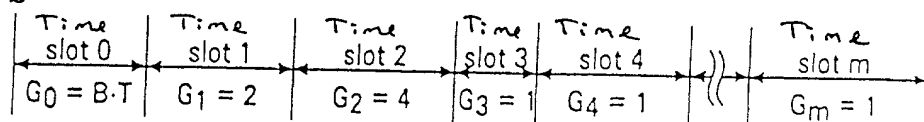
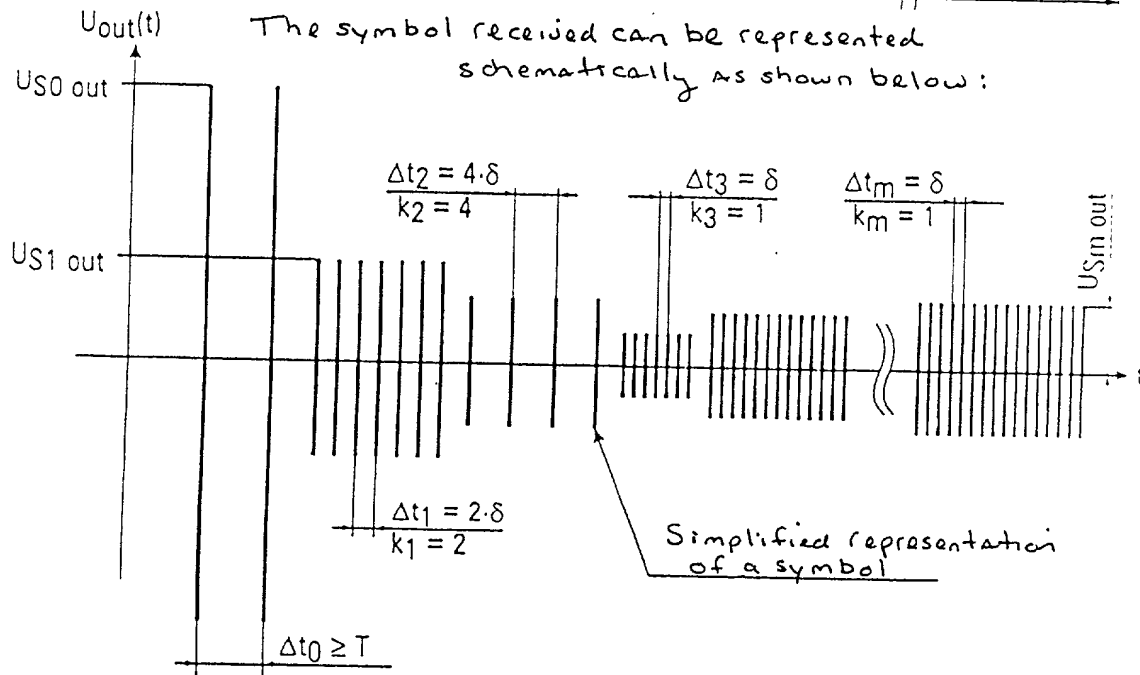
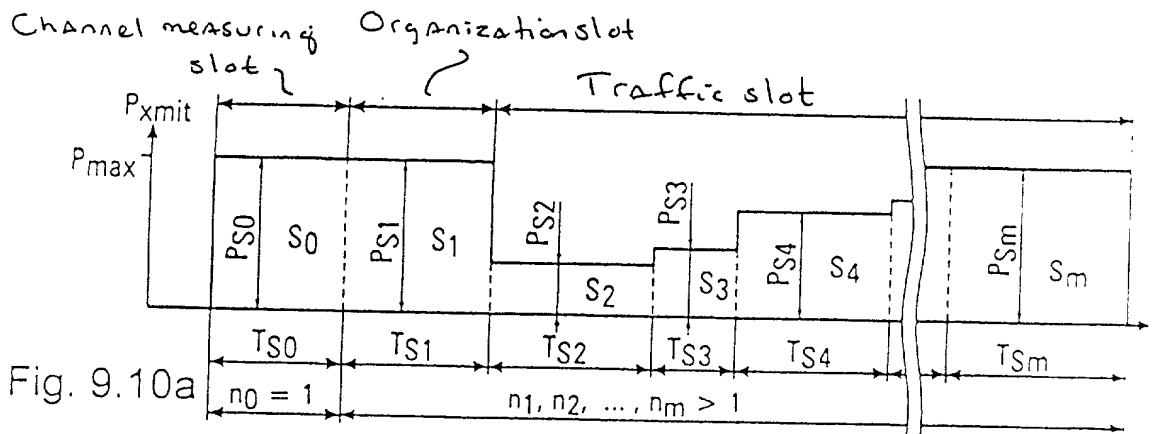
$$T_F = \sum_{i=0}^m T_{Si}$$

$T_{s0}, T_{s1}, T_{s2} \dots T_{sm} =$   
duration of timeslots  
0, 1, 2, ... m

Fig. 9.9 RESOURCE Allocation for Sampling System w/ TDMA

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Example of received signal according to the time-despreading method  
For resources allocated as in Fig 9.9.



$$G_i = \frac{B \cdot T}{n_i}; \quad i = 0, 1, 2, \dots, m$$

$$U_{Si \text{ out}} = \sqrt{G_i \cdot \frac{P_{Si} \cdot R_0}{A_{link i}}} = \sqrt{\frac{B \cdot T \cdot P_{Si} \cdot R_0}{n_i \cdot A_{link i}}}$$

Fig. 9.10 EXAMPLE OF RECEIVED SIGNAL

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Example of received signal according to the time-despreading method (contd.)

where:

- $A_{link 0}, A_{link 1}, \dots, A_{link m}$  - damping of transmitter  $\leftrightarrow$  receiver link and the effective frequency bandwidth of the system for time slots  $0, 1, 2, \dots, m$
- $G_0, G_1, G_2, \dots, G_m$  - Additional system gain for timeslots  $0, 1, 2, \dots, m$
- $k_0, k_1, k_2, \dots, k_m$  - distance between symbols (expressed as integral multiples of the  $\sigma$  time) for time slots  $0, 1, 2, \dots, m$
- $R_0$  - nominal value of the load resistance
- $T$  - duration of chirp signal
- $\Delta t_0, \Delta t_1, \Delta t_2, \dots, \Delta t_m$  - intersymbol distance for timeslots  $0, 1, 2, \dots, m$
- $U_{S0 out}, U_{S1 out}, \dots, U_{Sm out}$  - Amplitude of the de-spread symbol for time slot number  $0, 1, 2, \dots, m$  (o.g. output of the dispersive delay line  $\rightarrow$  see Fig 9.2)
- $B$  - effective frequency bandwidth of the system.

$$U_{S0 out} = \sqrt{\frac{B \cdot T \cdot P_{S0} \cdot R_0}{A_{link 0}}}$$

PULSE Amplitude for channel equalization method

$$U_{S1 out} = \sqrt{\frac{2 \cdot P_{S1} \cdot R_0}{A_{link 1}}}$$

Symbol Amplitude for the organization channel

$$U_{S2 out} = \sqrt{\frac{4 \cdot P_{S2} \cdot R_0}{A_{link 2}}}$$

Symbol Amplitude for the first traffic channel

$$U_{S3 out} = \sqrt{\frac{1 \cdot P_{S3} \cdot R_0}{A_{link 3}}}$$

Symbol Amplitude for the second traffic channel

$$U_{S4 out} = \sqrt{\frac{1 \cdot P_{S4} \cdot R_0}{A_{link 4}}}$$

Symbol Amplitude for the third traffic channel

$$U_{Sm out} = \sqrt{\frac{1 \cdot P_{Sm} \cdot R_0}{A_{link m}}}$$

Symbol Amplitude for the last traffic channel

Fig. 9.11 Example of Received Signal (contd.)

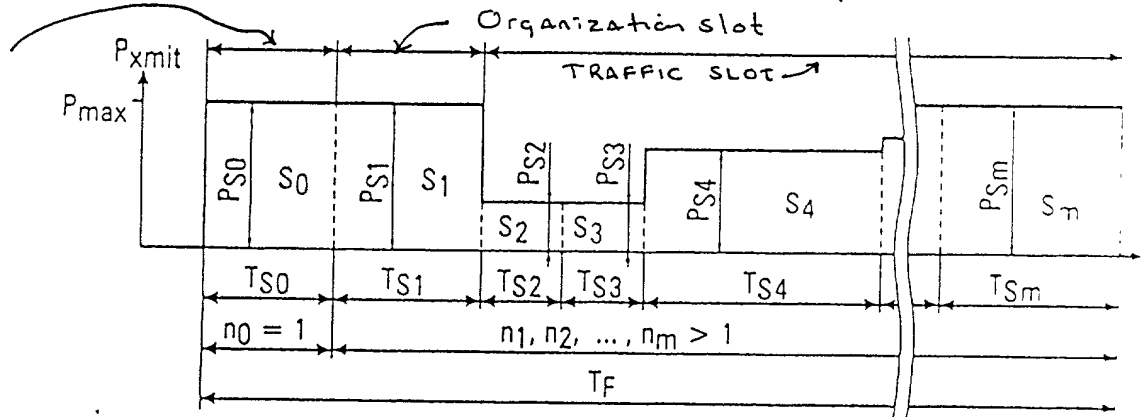
208020" E67900T  
1006793.020803

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Modified Allocation of resources according to changed system Requirements

- less time allocated for time slot  $S_2$  and  $S_3$
- less transmitter power allocated for time slot  $S_3$
- more time allocated for time slot  $S_4$

Channel measuring old



The received signal after modification can be represented schematically as shown below:

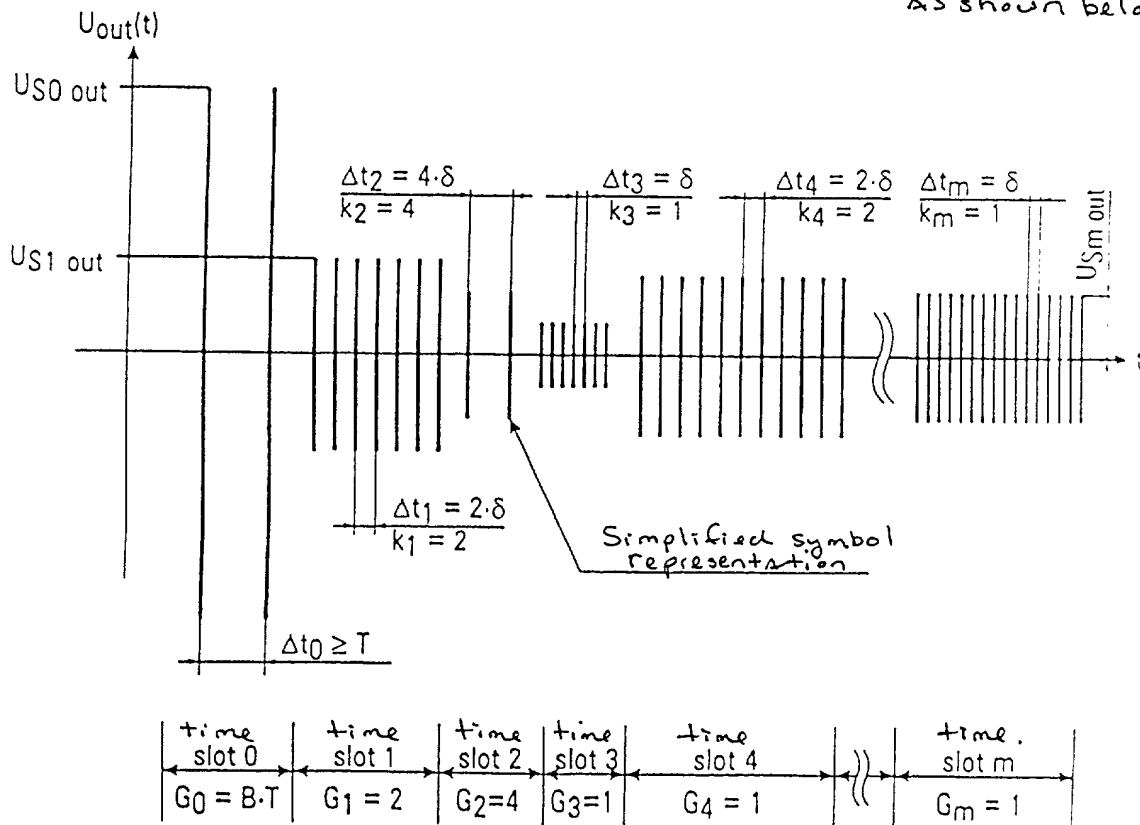


Fig. 9.12 RE-ALLOCATION OF RESOURCES



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Example of RECEIVED Signal After Allocation of resources (contd.)

Amplitude of the time - despread signal

$$US_{0 \text{ out}} = \sqrt{\frac{8 \cdot T \cdot PS_0 \cdot R_0}{A_{\text{link } 0}}}$$

Pulse Amplitude for channel equalization method

$$US_{1 \text{ out}} = \sqrt{\frac{2 \cdot PS_1 \cdot R_0}{A_{\text{link } 1}}}$$

Symbol Amplitude for the organization channel

$$US_{2 \text{ out}} = \sqrt{\frac{4 \cdot PS_2 \cdot R_0}{A_{\text{link } 2}}}$$

Symbol Amplitude for the first traffic channel

$$US_{3 \text{ out}} = \sqrt{\frac{1 \cdot PS_3 \cdot R_0}{A_{\text{link } 3}}}$$

Symbol Amplitude for the second traffic channel

$$US_{4 \text{ out}} = \sqrt{\frac{2 \cdot PS_4 \cdot R_0}{A_{\text{link } 4}}}$$

Symbol Amplitude for the third traffic channel

$$US_{m \text{ out}} = \sqrt{\frac{1 \cdot PS_m \cdot R_0}{A_{\text{link } m}}}$$

Symbol Amplitude for the last traffic channel

Fig. 9.13 RE - Allocation of Resources (contd.)

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END OF POWER Envelope for the transmitted signal after  
Time - Spreading

Power envelope for the specification of Fig 9.9.

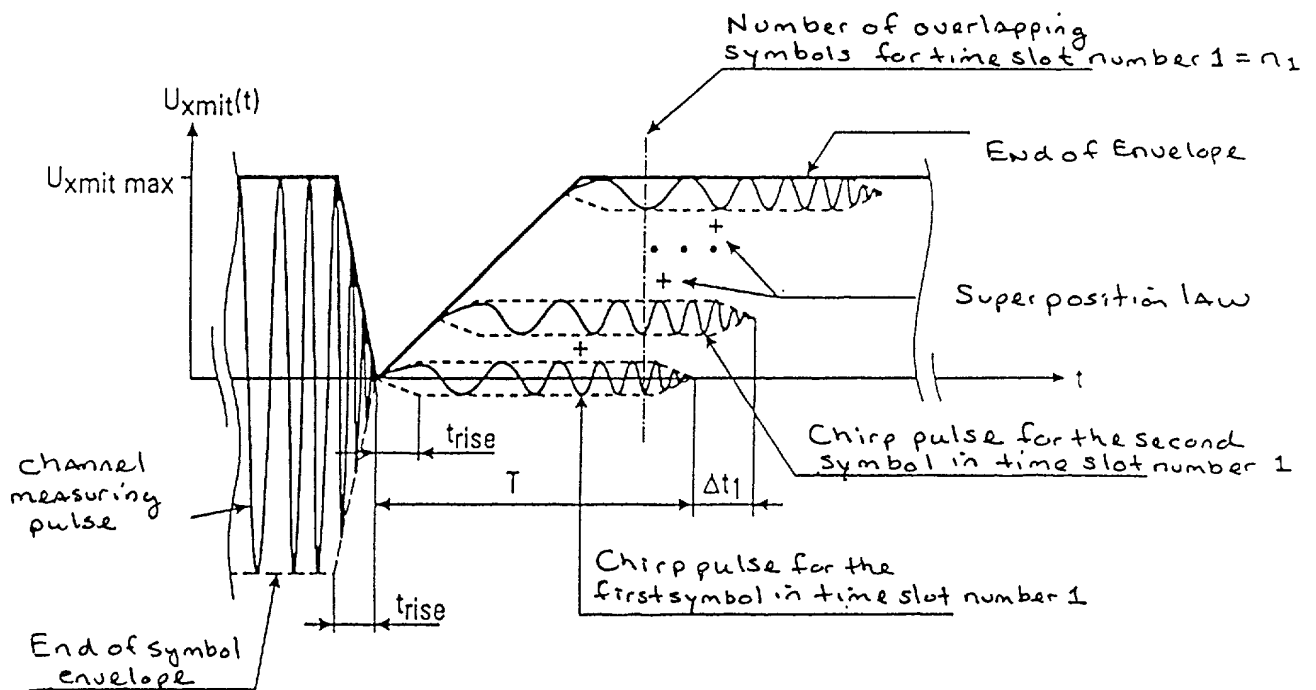
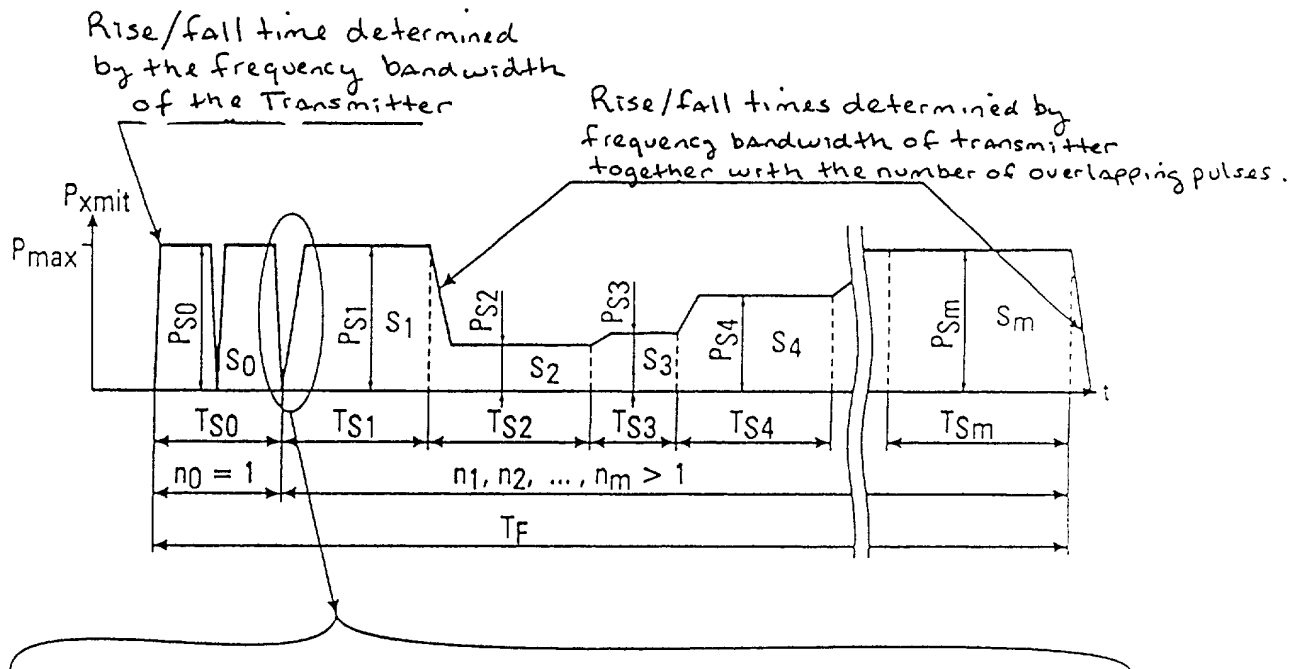


Fig. 9.14 Chirp Pulse Overlapping